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APOLLO APPLICATIONS PROGRAM

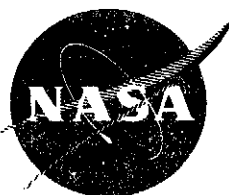
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PROGRAM DIRECTIVE #14

FLIGHT MISSION DIRECTIVE

FOR

AAP-3A



**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON D.C. 20546**

APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 14

TO : Distribution

FROM: *John H. Fisher for*
DIRECTOR, APOLLO APPLICATIONS

SUBJECT: Flight Mission Directive for Mission AAP-3A

REF : (a) Apollo Applications Planning Schedule, ML-13A, dated January 5, 1968
(b) Apollo Flight Mission Assignments Directive, M-D MA 500-11, dated January 1968
(c) Apollo Applications Test Requirements Document, NHB 8080.3, dated October 13, 1967
(d) Apollo Applications Program Directive No. 11 dated February 26, 1968
(e) Apollo Program Directive No. 15 dated January 25, 1966
(f) Reliability and Quality Assurance Plan, NHB 5300.5, dated May 1967

PURPOSE: This directive defines AAP requirements and responsibilities to initiate those planning actions prerequisite to execution of the AAP-3A Mission. Commitment of funds or technical effort associated with implementation of this directive must be in accordance with authorization provided by NASA Project Approval Documents. The mission is scheduled for launch as indicated in reference (a) in the event that the launch vehicles and spacecraft assigned to the Apollo-Saturn missions, reference (b), are not required to support the mainline Apollo Program.

1.0 MISSION PURPOSE

The purposes of the AAP-3A Mission are as follows:

- a. Qualify man, evaluate his support requirements and determine human task performance capabilities on long duration manned space flight missions.
- b. Demonstrate feasibility of:
 - (1) reactivating a Saturn I Workshop that has been left unattended in earth orbit for several months, and

- (2) reusing a Saturn I Workshop as a base of operations for the conduct of experiments in astronomy, science, applications, technology, engineering and medicine.

2.0 MISSION OBJECTIVES

- 2.1 Primary Objectives: The primary objectives of the AAP-3A Mission are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated. Experiment assignments are tentative as indicated in Section 5 below.
- a. Obtain data to evaluate space flight environmental effects on the crew of a mission duration of up to 56 days (Experiments M018R, M050R, M051R, M052, M053R, M055R, M056R and M058R).
 - b. Determine feasibility of reactivating and operating the Saturn I Workshop (Experiment M402R and elements of M487R) as a habitable space structure for a period of up to 56 days from the AAP-3A launch date through evaluation of the CSM/S-IVB/Airlock/Multiple Docking Adapter to include the following:
 - (1) subsystems performance, and
 - (2) astronaut mobility and work capability in both intra- and extra-vehicular activity.
- 2.2 Secondary Objectives: The secondary objectives of Mission AAP-3A are summarized below. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the Mission Rules. Experiment assignments are tentative as explained in Section 5 below.
- a. Demonstrate the feasibility of reusing experiments left in orbit from the AAP-1/AAP-2 Mission. (
 - b. Obtain data prerequisite to identification of earth resources and development of improved cartographic procedures (Experiment S065R).
 - c. Obtain engineering and technological data needed for development of launch vehicle tracking equipment (Experiment T018R).
 - d. Obtain data in the areas of bioscience and astronomy (Experiments S019R, S020R, S027R and S072).

- e. Leave the Saturn I Workshop in orbit for future reuse and refurbishment.
- f. Obtain data to develop a more complete understanding of the physical characteristics of earth atmosphere and extra-atmospheric environment (Experiments S018RC, S063, S073 and S028).
- g. Verify the ability of mission ground support systems to support mission activities of extended duration.

3.0 GENERAL FLIGHT PLAN

- 3.1 Launch Vehicle Powered Flight: AAP-3A is a manned flight involving a Saturn IB launch vehicle, a modified Apollo Block II CSM and resupply provisions as needed to sustain a 56-day mission. It will be launched from LC 34 at KSC at a time and azimuth to facilitate rendezvous with the Saturn I Workshop left in orbit from the AAP-1/AAP-2 Mission. Injection orbit will be 81 x 120 n. mi. nominal.
- 3.2 Spacecraft Flight Profile: The AAP-3A spacecraft will be injected into an initial 81 x 120 n. mi. orbit. It will circularize at 120 n. mi. and then perform an orbital transfer to rendezvous with the Saturn I Workshop. The spacecraft will hard dock to the axial port of the Multiple Docking Adapter and the Workshop will be reactivated for manned operations. Workshop operations will continue on an open-ended basis for up to 56 days with primary emphasis in the experiment area directed toward attainment of medical data associated with long term crew exposure to the zero G environment. At the conclusion of the mission, the CM will return to earth using the Service Module SPS to provide the primary deorbit impulse. Emergency deorbit backup will be provided (solid retrorockets and RCS under study).
- 3.3 Recovery: Water recovery to be developed consistent with the above-stated profile characteristics and the normal recovery constraints associated with the deployment of recovery forces and the local lighting conditions at the time of recovery.
- 3.4 Mission Support Requirements: These requirements will be supplied in a "Program Support Requirements" document to be issued by the Operations Support Requirements Office, Mission Operations, OMSF, not later than four months prior to launch.

4.0 CONFIGURATION

- 4.1 Launch Vehicle: A Saturn IB launch vehicle as assigned by reference (a) will be used for the AAP-3A flight. Modifications will be limited to the minimum necessary to achieve proper trajectory stabilization and control.
- 4.2 Spacecraft: The AAP-3A spacecraft will be an Apollo Block II CSM modified to:
- a. Operate with the Airlock and hard dock to the MDA as dictated by mission requirements.
 - b. Carry and support experiment hardware.
 - c. Incorporate resupply provisions in addition to those remaining from AAP-1/AAP-2 as needed to sustain a 56-day mission.
 - d. Provide an extended capability RCS system as required to accomplish mission objectives.
 - e. Incorporate a backup deorbit system to the primary SPS deorbit system (solid retrorockets and RCS under study).
 - f. Provide a control system for cluster reactivation and regulation of the two-gas life support system.
 - g. Incorporate 56-day fuel cells.
 - h. Provide cryogenic consumables to support fuel cell power generation for a 56-day mission.
 - i. Provide for power transfer between the CSM and the Airlock power distribution system.
 - j. Permit utilization of the CM communications system as a cluster voice communications center.

5.0 EXPERIMENTS

The following are candidate experiments tentatively assigned for execution on AAP-3A. They are listed in relative order of priority, subject to MSFEB approval.

<u>Objective</u>	<u>Exp. No.*</u>	<u>Title</u>	<u>Dev. Center</u>	<u>Launch Location</u>
Primary	M402R	Orbital Workshop	MSFC	--
Secondary**	M487R	Habitability/Crew Quarters	MSFC	--
Primary	M051R	Cardiovascular Function Assessment	MSC	--
Primary	M050R	Metabolic Activity	MSC	--
Primary	M052	Bone and Muscle Changes	MSC	CM
Primary	M056R	Non-Gravimetric Mass Measurement	MSC	--
Primary	M058R	Human Mass Measurement Device	MSC	--
Primary	M053R	Human Vestibular Function	MSC	--
Primary	M018R	Vectorcardiogram	MSC	--
Primary	M055R	Time and Motion Study	MSC	--
Secondary	M509R	Astronaut Maneuvering Unit	MSC	--
Secondary	M479R	Zero G Flammability	MSC	--
Secondary	M493R	Electron Beam Welding	MSFC	--
Secondary	S027R	Galactic X-ray Mapping	MSFC	IU
Secondary	T018R	Precision Optical Tracking	MSFC	IU
Secondary	S018RC	Micrometeorite Collection	MSC	--
Secondary	S065R	Multi-band Terrain Photography	MSC	--
Secondary	S073	Gegenschein/Zodiacal Light	MSC	CM
Secondary	S072	Circadian Rhythm-Vinegar Fly	ARC	CSM
Secondary	S019R	UV Stellar Astronomy	MSC	--
Secondary	S020R	UV/X-ray Solar Photography	MSC	--
Secondary	S063	UV Airglow Horizon Photography	MSC	CM
Secondary	S028	Dim Light Photography	MSC	CM

5.1 Implementation: The following instructions are established for development, payload integration and mission planning activities associated with the above experiments.

- a. Within currently authorized funding authority, develop all new experiments and procure necessary replacement flight hardware for those experiments which were carried and/or performed on the AAP-1/AAP-2 Mission and are scheduled for repeat on AAP-3A.

*R - Designates experiment was performed on AAP-1/AAP-2 Mission and is scheduled for reactivation and reuse on AAP-3A. Only those elements of hardware prerequisite to repetition will be transported to orbit.

RC - Designates experiment was initiated on AAP-1/AAP-2 Mission and is scheduled for completion on AAP-3A.

**Elements of this experiment vital to accomplishment of this mission are to be considered primary objectives.

- b. Integrate all new experiments assigned to AAP-3A and all experiment hardware which is prerequisite to the repeat or reuse of experiments carried on AAP-1 and AAP-2. Integration should provide for data, instrumentation or hardware return, as necessary, for experiments initiated on the AAP-1/AAP-2 Mission and reused on AAP-3A.
- c. Guidance for operational planning will be furnished upon completion of feasibility studies associated with the experiment payload on the AAP-1/AAP-2 Mission.

6.0 SUPPORTING GROUND TEST CONSTRAINTS

The test program will be developed in accordance with the Apollo Applications Test Requirements document (reference (c)) and appropriate test specifications. Mission Requirements documents prepared by the centers in support of these missions will identify by inclusion or reference the test constraints which must be lifted prior to mission execution.

6.1 Qualification: Components of the spacecraft, launch vehicle, SLA, flight experiment hardware and associated support systems whose failure would jeopardize either crew safety (Category I) or the accomplishment of a primary mission objective (Category II) and which have not been flight tested will be ground qualified and/or certified prior to launch as described in Appendix D of reference (c). Basic Apollo hardware which has been flight tested (i.e., CSM) will be subjected to additional ground qualification and/or certification tests as required to provide confidence in meeting the long duration and other pertinent AAP requirements.

6.2 Launch Vehicles: The following flight stage tests will be performed on the AAP-3A launch vehicle.

- a. Manufacturing checkout of the IU, S-IB and S-IVB flight stages.
- b. Static test of the S-IB and S-IVB flight stages.
- c. Post static checkout of the S-IB and S-IVB flight stages.
- d. KSC integrated prelaunch tests of the IU, S-IB and S-IVB flight stages.

6.3 AAP Experiments: The following ground tests will be performed:

- a. Experiment development tests.
- b. Qualification tests for each experiment.
- c. Payload integration tests of experiment and associated support systems with carriers.
- d. Factory checkout and acceptance test of experiment and associated support systems.
- e. KSC prelaunch tests.

6.4 Spacecraft: The following major flight article ground tests will be performed on the AAP-3A CSM:

- a. Qualification and/or certification tests on the basic Apollo CSM as required to meet the long duration and other pertinent AAP mission requirements.
- b. Qualification tests for AAP peculiar subsystems modifications to verify operation for the AAP-3A Mission.
- c. Factory checkout and acceptance tests.
- d. Integrated systems tests.
- e. KSC prelaunch tests.

6.5 Integrated Systems Tests: Integrated systems tests will be conducted to verify that flight hardware is physically, functionally and operationally compatible with associated ground support systems and mating hardware in the cluster configuration. Cluster configuration tests will be conducted with flight articles where practicable and with flight configured prototypes, simulators or master gauges, as appropriate, when the interfacing flight article cannot be made available. For the AAP-3A Mission, the CSM-MDA/Airlock hardware interface will be verified.

6.6 Prior Flight Missions: All launch vehicle and spacecraft test anomalies resulting from previous missions which could degrade or interfere with primary objectives will be evaluated and corrected prior to the launch of AAP-3A.

- 6.7 Design Certification Review (DCR): An AAP DCR will be conducted to certify all new hardware and all changes from the standard Apollo hardware required for this mission. Basic Apollo hardware already certified in previous DCR's will be recertified as required to meet AAP extended life and/or performance requirements. This review will also include certification of experiments likely to affect flight worthiness, manned flight safety and/or mission primary objectives. The DCR shall be in accordance with Apollo Applications Program Directive No. 11 (reference (d)).
- 6.8 Certification: A Certification of Flight Worthiness (reference (c)) for each stage, IU, SLA and spacecraft is required prior to shipment from the factory and after static firing if appropriate. In addition, experiments whose failure would jeopardize crew safety or the accomplishment of a primary mission objective (Category I or II) will also require preparation of a COFW. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close-out of open items prior to launch will be in accordance with Apollo Program Directive No. 15 (reference (e)) as to be modified for AAP.

7.0 RELIABILITY AND QUALITY ASSURANCE

A Reliability and Quality Assurance Program will be developed in accordance with the Reliability and Quality Assurance Plan (reference (f)) issued by AAP, R&QA, OMSF.

8.0 RESPONSIBILITIES

Center responsibilities for planning and future implementation of this mission are as follows:

8.1 MSFC:

- a. Provide the Saturn IB launch vehicle and required vehicle and GSE modifications.
- b. Develop assigned experiments and supporting hardware.

- c. Develop GSE as required for assigned experiments.
- d. Integrate all experiments designated for transport on the AAP-3A launch vehicle.
- e. Conduct guidance and control dynamics analyses for the ground launched space vehicle configuration and develop the requisite launch vehicle guidance and control capability.
- f. Analyze the cluster maneuver dynamics for the AAP-3A Mission.
- g. Provide launch vehicle performance constraints, systems data and guidance support to MSC for mission planning.
- h. Provide technical support to MSC concerning crew training procedures and flight operations planning for the Saturn I Workshop reactivation and the MSFC assigned/designated experiments.
- i. Provide operational support to MSC as required during AAP-3A flight operations.
- j. Provide technical support to MSC concerning expendable resupply requirements and hardware development as related to the Saturn I Workshop.
- k. Provide test requirements which are suitable for KSC development of test procedures for MSFC end items.
- l. Provide technical support to KSC as required during the acceptance, modification, prelaunch checkout and the launch phases of this mission.

8.2 MSC:

- a. Provide the CSM and associated GSE required for the AAP-3A Mission.
- b. Define the resupply requirements and develop the resupply hardware to sustain a mission of up to 56 days duration.
- c. Develop assigned experiments and supporting hardware.
- d. Develop GSE as required for assigned experiments.
- e. Integrate all experiments designated for transport on the AAP-3A spacecraft.
- f. Conduct thermal balance analyses for the AAP-3A orbital assemblage.

- g. Conduct analyses in coordination with MSFC in the areas of instrumentation and communications, electrical power distribution and expendables distribution for the space module cluster configuration as required for development of the CSM and resupply package hardware.
- h. Plan the mission and develop the astronaut flight plan including appropriate inputs from MSFC for the Saturn I Workshop and MSFC assigned experiments.
- i. Plan and execute flight control, experiment and recovery operations.
- j. Train the astronaut crew.
- k. Provide test requirements which are suitable for KSC development of test procedures for MSC end items.
- l. Provide technical support to KSC as required during the acceptance, modification, prelaunch and launch phases of this mission.

8.3 KSC:

- a. Prepare checkout procedures and conduct prelaunch checkout of the launch vehicle with the associated GSE.
- b. Prepare checkout procedures and conduct prelaunch checkout of the spacecraft, resupply package hardware and experiment hardware for AAP-3A with the associated GSE.
- c. Plan and execute space vehicle launch operations.
- d. Provide technical support as required to MSC and MSFC concerning the KSC implementation of modifications to flight hardware and GSE hardware.
- e. Prepare integrated space vehicle checkout procedures and conduct integrated checkout of the space vehicle with its associated ground support systems.

9.0 IMPLEMENTATION

MSC, MSFC and KSC shall develop Mission Requirements documents which will permit them to implement the requirements stated herein. The MSC and MSFC requirements will be combined in a jointly signed-off directive.

May 22, 1968

Subsequent changes and future revisions to center Mission Requirements documents noted above which conflict with the requirements stated herein will require coordination between the centers and the review and approval of the Apollo Applications Director. Other revisions to center Mission Requirements documents will be coordinated between centers as required with ten copies submitted to the Director, Apollo Applications, Code ML, for information.

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AA/Morgan

AA-ADV/Hock

AA-SVO/Raffaelli (60)

LO/Petrone

AP/Middleton

EX/Murphy

TS/Clark

DE/Preston

IS/Miller

SO-PLN/Manton

MSC

AA/Gilruth

AB/Deputy Director

AD/West

KA/Thompson (85)

PA/Low (5)

PA/Rees

EA/Faget

TA/Hess (5)

ET/Stoney

FA/Kraft (2)

FA4/Felder

FC/Hodge (8)

FM/Mayer (2)

FM14/Parten (3)

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FS/Dunseith (2)

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CF34/Jones (2)

DA/Berry

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